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DICKSTEIN SHAPIRO LLP
1825 EYE STREET NW
Washington, DC 20006-5403

EXAMINER

YU, JAE UN

ART UNIT	PAPER NUMBER
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2185

DATE MAILED: 10/23/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/822,793	Applicant(s) HORN ET AL.	
	Examiner Jae U. Yu	Art Unit 2185	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 July 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3,4,6,7,9 and 11-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3,4,6,7,9 and 11-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

The examiner acknowledges the applicant's submission of the amendment dated 7/31/2006. At this point claims 1, 3, 4, 6, 7, 9, 11, 15 and 17 have been amended and claims 2, 5, 8 and 10 have been canceled. Thus, claims 1, 3, 4, 6, 7, 9 and 11-18 are pending in the instant application.

Response to Amendment

In view of the applicant's amendment, the 35 USC 112 rejections for claims 1, 4, 11 and 15 are withdrawn.

Claim Rejections - 35 USC § 112

1. Claims 7 and 9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
2. Claims 7 and 9 are a means plus function claim, and interpreted according to 35 USC 112 Sixth Paragraph. However, the examiner cannot locate a corresponding apparatus for "searching said mappings" from the specification.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

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A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claims 1, 3, 4, 6, 7 and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by Smyers (US 2002/0026540).
2. Independent claim 1 discloses, “at a first one [**“Selected AVHDD”, Paragraph 33]** of said plurality of storage controllers, receiving a host command [**“Record Instruction”, Paragraph 33]** directed to a volume [**“Available AVHDD”, Paragraph 33]** of said storage system from a host”.

“Determining a target storage element [**“Media” 74 within a AVHDD that should record the data, Figure 3, Paragraph 33]** of said storage system corresponding to said volume; Determining a target storage controller [**Determining AVHDD that should record the data, Paragraph 33]** corresponding to said target storage element”

“If said target storage controller [**“Available AVHDD”, Paragraph 33]** is not said first one [**“Selected AVHDD”, Paragraph 33]** of said plurality of storage controllers, forwarding the host command to said target storage controller [**Forwarding the command to recording AVHDD, Paragraph 33]**”

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“At the target storage controller [**“Recording AVHDD”, Paragraph 33**], receiving the host command [**Receiving the recording command, Paragraph 33**] forwarded by the first one [**“Selected AVHDD”, Paragraph 33**] of said plurality of controllers”

“Executing said host command [**Recording the stream of data, Paragraph 33**]”

“Forwarding, to said first one of said plurality of storage controllers, an execution status associated with said host command” **Smyers discloses forwarding a recording status associated with the recording command to the “prior recording AVHDD in paragraph 34-35. The “prior recording AVHDD” corresponds to the “selected AVHDD” (“first storage controller” from the claim) that stops and forwards the recording command if its capacity is low.**

“At said first one [**“Selected AVHDD”, Paragraph 33**] of said plurality of storage controllers, receiving said execution status” **Smyers discloses forwarding an recording status associated with the recording command to the “prior recording AVHDD in paragraph 34-35. The “prior recording AVHDD” corresponds to the “selected AVHDD” (“first storage controller” from the claim) that stops and forwards the recording command if its capacity is low.**

“Forwarding said execution status to said host [“Computer” 20, Figure 4]” The recording status is inherently forwarded to the computer to acknowledge the user the recording status.

“wherein said step of determining a target storage controller comprises searching a mapping table” Smyers discloses RAID techniques in paragraph 47 so a mapping between redundant disk arrays and controllers are inherently present. To determine a target storage, the mapping table is searched to locate a redundant disk that corresponds to the current target disk.

3. Claim 3 discloses, “before receiving a host command at said first one of said plurality of storage controllers, creating said mapping table to reflect a mapping between volumes and controllers of said system. Smyers discloses RAID techniques in paragraph 47 so a mapping between redundant disk arrays and controllers are inherently present.

4. Independent claim 4 discloses, “at a first one [“Selected AVHDD”, Paragraph 33] of plurality of storage controllers, receiving a host command [“Record Instruction”, Paragraph 33] directed to a virtual volume [“Single Media Storage Device”, Paragraph 29] of said storage system from a host”.

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“Determining a plurality of logical volumes [**“Media” 74 in each AVHDD, Figure 3**] of said storage system corresponding to said virtual volume”

“Determining a plurality of target storage controllers [**“AVHDDs”, Figure 4**] from said plurality of storage controllers corresponding to said plurality of logical volumes”

“Sending a component command to each of said plurality of target storage controllers [**Forwarding recording command to each of recording AVHDDs, Paragraph 33-34**], the component command for a particular one of said plurality of target storage controllers corresponding to at least a portion of the host command and relating to the logical volume [**“Media” 74 in each AVHDD, Figure 3**] associated with the particular target controller”

“At each of said plurality of the target storage controllers [**“Recording AVHDDs”, Paragraph 33-34**], receiving the component command [**Receiving the recording command, Paragraph 33**] sent by the first one of said plurality of controllers [**“Selected AVHDD”, Paragraph 33**]”

“Executing said component command [**Recording the stream of data, Paragraph 33**]”

“Forwarding, to the first one of said plurality of storage controller, an execution status”
Smyers discloses forwarding a recording status associated with the recording

command to the “prior recording AVHDD in paragraph 34-35. The “prior recording AVHDD” corresponds to the “selected AVHDD” (“first storage controller” from the claim) that stops and forwards the recording command if its capacity is low.

“At said first one [“Selected AVHDD” 36, Paragraph 33, Figure 4] of said plurality of storage controllers, receiving said execution status from each one [“AVHDDs” 32 & 34, Figure 4] of said plurality of target storage controllers; determining an aggregate host command execution status from said received execution status” Smyers discloses forwarding an recording status associated with the recording command to the “prior recording AVHDD in paragraph 34-35, wherein the AVHDD 32 forwards the recording status to the AVHDD 34 after that, the AVHDD 34 forwards the final aggregated recording status to the AVHDD 36.

“Forwarding said aggregate host command status to said host [“Computer” 20, Figure 4]” The recording status is inherently forwarded to the computer to acknowledge the user the recording status.

“wherein said step of determining a target storage controller comprises searching a mapping table” Smyers discloses RAID techniques in paragraph 47 so a mapping between redundant disk arrays and controllers are inherently present. To

determine a target storage, the mapping table is searched to locate a redundant disk that corresponds to the current target disk.

5. **Claim 6** discloses, "before receiving a host command at said first one of said plurality of storage controllers, creating said mapping table to reflect a mapping between virtual volumes and logical volumes of said storage system". **Smyers discloses RAID techniques in paragraph 47 so a mapping between physical redundant disk arrays and virtual disk are inherently present.**

6. **Independent claim 7** discloses, "a plurality of storage controllers [**"AVHDDs", Figure 4]**".

"At least one host port [**Element 62, Figure 3**] for communicating with a plurality of hosts [**"Controller" 80, "Computer" 20, Figure 4]**"

"At least one storage element port [**Element 62, Figure 3**] for communicating with a plurality of storage elements [**"Media" 74 within each AVHDD, Figure 3]**"

"An interconnect [**"IEEE 1394-1995 Serial Bus", Paragraph 23]** connected to each of said plurality of storage controllers"

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"At least one storage element [**"Media" 74, Figure 3**], each storage element being coupled to a respective storage element port [**"R/W Channel" 72, Figure 3**]"

"a configuration controller [**"Object Descriptor", Paragraph 40**] for setting up mappings between storage volumes [**"AVHDDs", Paragraph 40**] and storage elements [**"Data Stream", Paragraph 40**]"

(The following limitation is means plus function claim limitation and interpreted according to 35 USC 112 sixth paragraph.)

"Wherein said plurality of storage controllers further comprise means ("Processing Element" 412, Figure 4 of the Applicant's Specification) for processing a host command received on any host port targeted to a storage volume on any one of said plurality of storage elements" **Smyers disclose processing a recording command in each AVHDDs in paragraphs 33-34. Since the AVHDDs perform the same function as the "processing element" from the claim, the AVHDDs inherently comprise the "processing element".**

"means for searching said mappings [**inherent in RAID operations (See the "1st Point of Argument below)**]"

7. **Independent claim 9** discloses, "a plurality of storage controllers [**"AVHDDs", Figure 4**]"

“At least one host port **[Element 62, Figure 3]** for communicating with a plurality of hosts **[“Controller” 80, “Computer” 20, Figure 4]”**

“At least one storage element port **[Element 62, Figure 3]** for communicating with a plurality of storage elements **[“Media” 74 within each AVHDD, Figure 3]”**

“An interconnect **[“IEEE 1394-1995 Serial Bus”, Paragraph 23]** connected to each of said plurality of storage controllers”

“At least one storage element **[“Media” 74, Figure 3]**, each storage element being coupled to a respective storage element port **[“R/W Channel” 72, Figure 3]”**

“a configuration controller for setting up mappings between virtual volumes and logical volumes”. **Smyers discloses RAID techniques in paragraph 47 so a mapping between logical redundant disk arrays and virtual disk are inherently present.**

Since the system performs the same function as the “configuration controller” from the claim, the system inherently comprises the “configuration controller”.

(The following limitation is means plus function claim limitation and interpreted according to 35 USC 112 sixth paragraph.)

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"Wherein said plurality of storage controllers further comprise means ("Processing Element" 412, Figure 4 of the Applicant's Specification) for processing a host command received on any host port targeted to a virtual volume [Virtual "Single Media Storage Device", Paragraph 29] on said plurality of storage elements" Smyers disclose processing a recording command in each AVHDDs in paragraphs 33-34. Since the AVHDDs perform the same function as the "processing element" from the claim, the AVHDDs inherently comprise the "processing element".

"means for searching said mappings [inherent in RAID operations (See the "1st Point of Argument below)]"

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 11-16 are rejected under 35 U.S.C. 103 (a) as being obvious over Smyers (US 2002/0026540) in view of Dekoning et al. (US 2001/0002480).
2. As per independent claim 11, Smyers disclose, "a high speed interconnect [“IEE 1394-1995 Serial Bus”, Paragraph 23]”.

"A plurality modules [**"AVHDDs", Figure 4]**"

"An interconnect port [**Element 62, Figure 3]**, coupled to said high speed interconnect"

"A storage port [**"R/W Channel" 72, Figure 3]**, for coupling to a storage device"

"A host port [**Element 62, Figure 3]**, for coupling to a host [**"Computer" 20, Figure 4]**"

"A processing element [**"Buffer Controller" 68, Figure 3]**, coupled to said interconnect port, said storage port, and said host port"

"wherein the processing elements of each of said modules are configured to search mappings between storage volumes and storage devices [**inherent in RAID operations (See the "1st Point of Argument below)]**"

Smyers does not disclose expressly, "a cache memory".

Dekoning et al. disclose a "cache" in Figure 4.

Smyers and Dekoning et al. are analogous art because they are from the same field of endeavor of data control.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify Smyers by including a cache as taught by Dekoning et al. in Figure 4.

The motivation for doing so would have been to further improve the performance of the RAID subsystem write operations as expressly taught by Dekoning et al. in paragraph 9.

Therefore, it would have been obvious to combine Dekoning et al. with Smyers for the benefit of improved performance to obtain the invention as specified in claim 11.

3. **Claim 12** discloses, "said high speed interconnect is a serial interconnect [**"IEE 1394-1995 Serial Bus", Paragraph 23, Smyers]**".

4. **Claim 13** discloses, "said high speed interconnect is a fibre channel loop [**Fibre Channel Loop, Paragraph 30, Dekoning et al.]**".

5. **Claim 14** discloses, "said high speed interconnect is a switched serial network [**"IEE 1394-1995 Serial Bus", Paragraph 23, Smyers]**". The IEE 1394-1995 serial network in Figure 4 is switched since the "controller" 80 can "select" one of the AVHDDs to send recording command (Paragraph 33).

6. As per **independent claim 15**, Smyers discloses, "a primary interconnect [**"IEE 1394-1995 Serial Bus", Paragraph 23]**".

“A plurality of modules [**“AVHDDs”, Figure 4**]

“An interconnect port [**Element 62, Figure 3**], coupled to said primary interconnect”

“A storage port [**“R/W Channel” 72, Figure 3**], for coupling to a storage device”

“A host port [**Element 62, Figure 3**], for coupling to a host [**“Computer” 20, Figure 4**]

“A processing element, coupled to said interconnect port, said storage port, and said host port; wherein the processing element of each of said modules are configured to process a host command for accessing a virtual volume [**Virtual “Single Media Storage Device”, Paragraph 29**] by causing each module [**“AVHDDs”, Figure 4**] associated with said virtual volume to access its respective storage device [**“Media”, Figure 3**].” Smyers disclose processing a recording command in each AVHDDs in paragraphs 33-34. Since the AVHDDs perform the same function as the “processing element” from the claim, the AVHDDs inherently comprise the “processing element”.

“and are configured to search mappings between virtual volumes and logical volumes[**inherent in RAID operations (See the “1st Point of Argument below**)]”

Smyers does not disclose expressly, "a cache memory".

Dekoning et al. disclose a "cache" in Figure 4.

Smyers and Dekoning et al. are analogous art because they are from the same field of endeavor of data control.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify Smyers by including a cache as taught by Dekoning et al. in Figure 4.

The motivation for doing so would have been to further improve the performance of the RAID subsystem write operations as expressly taught by Dekoning et al. in paragraph 9.

Therefore, it would have been obvious to combine Dekoning et al. with Smyers for the benefit of improved performance to obtain the invention as specified in claim 15.

7. **Claim 16** discloses, "a redundant interconnect ". **Smyers disclose that the each AVHDD have two "interconnects" attached to it in Figure 4.**

"Wherein each of said modules further comprises another interconnect port coupled to said redundant interconnect" **Smyers disclose that the each AVHDD have two ports coupled to the each interconnect in Figure 4.**

8. Claims 17 and 18 are rejected under 35 U.S.C. 103 (a) as being obvious over Smyers (US 2002/0026540) in view of Sadjadi (US 6,850,938).

9. As per independent claim 17, Smyers discloses, “receiving, at a first module **[“Selected AVHDD”, Paragraph 33]**, a first access request; receiving, at a second module **[“Recording AVHDD, Paragraph 33]**, a second access request **[Forwarded recording request, Paragraph 33]**”.

“Determining whether said received access request corresponds to either a read or write request to two or more storage elements if said received access request is determined to correspond to either a read or a write request to two or more storage elements, executing a coordination request” The received access request requires coordination if it is a recording request to two mirrored logical volumes (**Mirrored Data, Paragraphs 44-45**).

Smyers does not disclose expressly the rest of the claim limitations.

Sadjadi discloses, “executing a coordination request **[“Request for a lock”, Figure 2B]**”.

“If said coordination request is not granted **[“Yes” 240, Figure 2B]**, indicating in a conflict table **[Table 1, Column 9]** that said received access request is in conflict”

“Holding said access request” **Since the lock is denied, the access request is denied inherently.**

“If said coordination request is granted [**“No” 240, Figure 2B**], executing said received access request” **Since the lock is granted, the access request has an exclusive right to the storage (Column 7, Lines 10-15).**

“Searching said conflict table [**Table 1, Column 9**] to find an entry in conflict with said received access request; if said search is successful, notifying the module associated with said found entry [**Letting the next process to continue, Column 1, Lines 55-60**]”

“If said search is unsuccessful, releasing said coordination request [**Releasing lock, Column 6, Lines 55-62**]”

Smyers and Sadjadi are analogous art because they are from the same field of endeavor of storage management.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify Smyers by including the coordination process as taught by Sadjadi in Figure 2B.

The motivation for doing so would have been to reduce the size of database objects and transaction logs as expressly taught by Sadjadi in Column 3, Lines 50-55.

Therefore, it would have been obvious to combine Sadjadi with Smyers for the benefit of optimized storage use to obtain the invention as specified in claim 17.

10. **Claim 18** discloses, "searching a coordination data structure [**"Lock Table" 142, Figure 1, Sadjadi**] to find a data structure [**"Lock Data Structure" 144, Figure 1, Sadjadi**] having an address range encompassing an address range [**Lock data structure corresponding to the address range, Column 1, Lines 43-60, Sadjadi**] associated said received access request".

"If the data structure is found [**Step 236, Figure 2B, Sadjadi**], attempting to reserve said data structure [**Reserving the lock if there's no conflicts 240 & 248, Figure 2B, Sadjadi**]"

"If said attempt to reserve is not successful, indicating the said coordination is not granted [**Element 242, Figure 2B, Sadjadi**]"

"If said attempt to reserve is successful, indicating that said coordination request is granted [**Granting the exclusive access, Column 7, Lines 10-15**]"

"If said data structure is not found, allocating said data structure [**Element 238, Figure 2B, Sadjadi**] and indicating said coordination request is granted [**Granting the exclusive access, Column 7, Lines 10-15**]"

Arguments Concerning Prior Art Rejections

1st Point of Argument

Regarding claim 1, the applicant argues that Smyers does not disclose the claim limitation, "searching a mapping table" since searching a mapping table when determining a target storage controller is not inherent to Smyers because "a selected AVHDD could determine an available AVHDD by transmitting a message over the entire network to all components requesting responses from available AVHDDs". However, the examiner respectfully traverses with the applicant's arguments. For example, if the system wants to retrieve a recorded data from the plurality of AVHDDs, either desired addresses or contents is need to be searched (whether transmitted over the entire network or not) against the addresses of the AVHDDs or data contents of the AVHDDs. Therefore, the examiner considers such characteristic is inherent in both typical RAID system and Smyers.

2nd Point of Argument

The applicant further argues that Dekoning is not relevant to claim 1. The examiner directs the applicant's attention to the corresponding claim rejection above.

3rd Point of Argument

Regarding claim 1, the applicant argues that Smyers does not teach the claim limitation, "forwarding said execution status to said host". However, Smyers discloses forwarding data to be recorded to other AVHDDs if the current storage runs low in capacity, which means that from the host's view (i.e. an user or a computer), the plurality of AVHDDs appears as one virtual storage (Paragraph 52). Smyers further discloses a "playback" capability of the system in paragraph 52. Therefore, a host (an user or a computer) can verify the recording execution status by playing the recorded data.

4th Point of Argument

Regarding claim 17, the applicant argues that the combination of Smyers and Sadjadi do not teach the amended claim limitation, "determining whether said received access request corresponds to either a read or a write request to two or more storage elements". However, Smyers disclose, "mirrored data" in paragraphs 44-45, which comprises read or write requests to two or more storage elements".

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not

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mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

A. Claims Rejected in the Application

Per the instant office action, claims 1, 3, 4, 6, 7, 9 and 11-18 have received a second action on the merits and are subject of a second action final.

B. Direction of Future Correspondences

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jae Un Yu who is normally available from 9:00 A.M. to 5:30 P.M. Monday thru Friday and can be reached at the following telephone number: (571) 272-1133.

If attempts to reach the above noted examiner by telephone are unsuccessful, the Examiner's supervisor, Sanjiv Shah, can be reached at the following telephone number: (571) 272-4098.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For

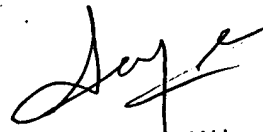
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10/3/2006

Jae Un Yu
Art Unit 2185

Jy


SANJIV SHAH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100